IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Larry C. Olsen et al.

Application No. 10/726,744

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Confirmation No. 6833

For: THERMOELECTRIC DEVICES AND APPLICATIONS FOR THE SAME

Examiner: Jeffrey Thomas Barton

Art Unit: 1795

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AMENDMENT

This responds to the Office action dated October 1, 2009. Please amend the referenced application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2.

Remarks begin on page 6.

Listing of Claims

1. (Presently Amended) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a co-sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a co-sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement;

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x and y form a non-stoichiometric compound and wherein x is about 2 and y is about 3; and

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration~~; and~~

~~wherein the p-type or the n-type thermoelements have L/A ratios from about 500 cm^{-1} to about 10,000 cm^{-1}~~.

2. (Withdrawn) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement;

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein and x is about 2 and y is about 3;

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration; and

wherein the p-type or the n-type thermoelements have L/A ratios from about 500 cm^{-1} to about 10,000 cm^{-1}.

3. (Previously presented) The thermoelectric power source of claim 1 wherein the p-type and the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein x is about 2 and y is about 3.

4. (Canceled)

5. (Previously presented) The thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of from 50 μW to 1 W.

6. (Previously presented) The thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt.

7. (Original) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

8. (Previously presented) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 0.1 mm in thickness.

9. (Original) The thermoelectric power source of claim 1 further comprising at least about 1000 thermoelectric couples, wherein the thermoelectric power source has a power output of about 1 W with a voltage of at least about 1 volt.

10. (Previously presented) The thermoelectric power source of claim 1 wherein the p-type thermoelements each have a first width, the n-type thermoelements each have a second width, and the first width is different from the second width.

11. (Original) The thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements.

12. (Previously presented) The thermoelectric power source of claim 1 wherein the thin film p-type thermoelements or the thin film n-type thermoelements comprise Bi_xTe_y and Sb_xTe_y, or Bi_xTe_y and Bi_xSe_y.

13. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

14. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and provides voltages of greater than about 1 volt.

15. (Original) The thermoelectric power source of claim 14 wherein the thermoelectric power source produces power at temperature differences of about 20°C or less.

16. (Original) The thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements.

17. (Previously presented) The thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements ~~-~~comprise Sb_xTe_y, Bi_xTe_y and Sb_xTe_y, or Sb_xTe_y and Bi_xSe_y.

18. (Previously presented) The thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements comprise Bi_xTe_y and Sb_xTe_y.

Claims 19 – 22 (Canceled)

23. (Withdrawn) A thermoelectric power source comprising:

multiple thermocouples electrically connected to one another on an upper surface of a-single flexible substrate, the thermocouples comprising:

sputter deposited thin film p-type thermoelements having thicknesses of 0.1 mm or greater;

sputter deposited thin film n-type thermoelements alternatingly positioned adjacent the p-type thermoelements, the n-type thermoelements having a thickness of about 0.1 mm or greater;

wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W generated by the thermocouples on the-single flexible substrate; and

wherein the p-type thermoelements or the n-type thermoelements comprise a Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y alloy where x is about 2 and y is about 3.

24. (Withdrawn) The thermoelectric device of claim 23 wherein said multiple thermocouples electrically connected to one another are in series-parallel.

25. (Withdrawn) The thermoelectric power source of claim 23 wherein the p-type thermoelements have L/A ratios greater than about 500 cm^{-1}.

Claims 26 – 36 (Canceled)

37. (Previously presented) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) alternating thin film p-type and n-type thermoelements positioned on the upper surface of the flexible substrate;

(b) an electrically conductive member positioned on the flexible substrate, and electrically connecting a first end of the p-type thermoelement with a second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3; and

(c) wherein the flexible substrate is in a coil configuration.

38. (Previously presented) The thermoelectric power source of claim 37 wherein the p-type thermoelements or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

39. (Previously presented) The thermoelectric power source of claim 37 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

REMARKS

Claims 1-3, 5-18, 23-25 and 37-39 are pending in the present application. Reconsideration is respectfully requested.

October 1, 2009 Office Action

Although it is within the Examiner's discretion to review the claims as submitted in the Amendment filed on July 13, 2009, the Examiner refused to review the claims as filed as certain of the claims included the limitation of L/A ratio (which Applicants note were recited in the original claims as filed in 2003 and in the claims of every following Amendment thereafter). The Examiner issued a Restriction Requirement on April 13, 2009 – in response, the Applicants elected Group I, claims 1, 3, 5-18 and 37-39, which were drawn to claims reciting non-stoichiometric compounds.

Applicants note that independent claim 37 as presented in the previously filed Amendment remained essentially in the same form as presented prior to the issuance of the Restriction Requirement and was in the Group of elected claims. Accordingly, claim 37 remains in the present Amendment as previously presented. Claim 1 is amended to include the elected non-stoichiometric compounds limitation and delete the L/A ratio limitation even though such limitation had been previously searched and considered by the Examiner in prior Office actions before issuance of the Restriction Requirement. The Examiner's rejections presented in the April 13, 2009 Office action are addressed below.

Claim Rejections - 35 USC § 112

A. *Claims 1, 3 and 5-18 were rejected in the April 13, 2009 Office action under § 112, first paragraph, as allegedly failing to comply with the written description requirement.* The Examiner alleges that the claims contain subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner alleges that there is no disclosure of a "greater than an incidental amount of a non-stoichiometric compound" in the specification as originally filed. Applicants traverse.

Claim 1 recites, as amended herein, a non-stoichiometric compound but no longer recites "greater than an incidental amount of ...". Thus, to the extent that the Examiner's rejection under § 112 was based on the "incidental amount" the rejection is now moot. As to the possibility that the balance of

the Examiner's § 112, first paragraph rejection refers to the addition of the term non-stoichiometric,[1] Applicants note the following:

- Applicants respectfully submit that the Office has failed to satisfy its burden to articulate a *prima facie* case by only providing a mere conclusory statement with reference to only one piece of the evidence in the specification that supports the non-stoichiometric compound amendment to claim 1. Without adequate notice of the basis of this rejection, the burden to rebut this rejection with evidence and/or argument has not yet shifted to Applicant. Nonetheless, Applicants offer further evidence below of support for the amendment.

As to the burden on the Office in support of a § 112, first paragraph rejection, the MPEP repeatedly warns that the Office bears the initial burden of establishing a *prima facie* case when making such a written description rejection. (MPEP §§ 706.07, 2163 (III)(A)). A *prima facie* case requires a reasonable basis to challenge the adequacy of the written description. (MPEP § 2163.04). The MPEP equates this reasonable basis with "a preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a description of the invention defined by the claims." (MPEP § 2163(III)(A)). Consequently, the Office must provide a reasonable basis to reject a claim for failing to satisfy the written description requirement, and this requires "a full development" of the reasons showing that, by a preponderance of the evidence, a person of ordinary skill in the art would not recognize a description of the claimed invention in the disclosure.

In this regard, the MPEP expressly instructs that mere conclusory statements – such as what is presented in the present Office action – are insufficient. The Office cannot merely cite one statement and conclude a lack of written description in the application, rather than review the entire specification and evidence therein. After a complete review the Examiner the Office is to articulate the considerations made as to whether one of ordinary skill in the art would understand the invention as disclosed in the entire application, to encompass the non-stoichiometric compound. In the office action the Examiner merely states:

> There is no disclosure of a "greater than in incidental amount of a non-stoichiometric compound" in the specification as originally filed. The specification teaches Bi_xTe_y,

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[1] The Examiner's rejection is not clear as to whether he is referring to the "non-incidental amount" or the "non-stoichiometric compound" or both terms as a basis for his rejection. As is well understood by persons of skill in the relevant art, non-stoichiometric compounds are chemical compounds with an elemental composition that cannot be represented by a ratio of well-defined natural numbers, and therefore violate the law of definite proportions. Often, they are solids that contain crystallographic point defects, such as interstitial atoms and vacancies, which result in excess or deficiency of an element, respectively. Non-stoichiometry is especially important in solids, which are three-dimensional polymers and which tolerate mistakes. To some extent, entropy drives all solids to be non-stoichiometric but it is known to persons skilled in the art that the term describes materials where the non-stoichiometry is measurable, usually at least 1% of the ideal composition. See, for example, Lesley E. Smart, *Solid State Chemistry: An Introduction,* 3rd Edition, CRC Press. (2005).

Sb_xTe_y, and Bi_xSe_y materials where "x is typically about 2 and y is typically about 3" (Page 10, lines 6-8).

(Office action p. 6, paragraph 11). As stated in the MPEP, the Office must adequately explain the perceived shortcomings of the application so that Applicants are properly notified and able to respond. The Office has failed to do so; nonetheless, Applicants address below the rejection as if a *prima facie* case were able to be, and had been made, in order to speed what is already a lengthy prosecution.

➢ As discussed in the previously filed Amendment, one of ordinary skill in the art would reasonably conclude that Applicants' disclosure adequately described the claimed invention at the time of filing based on a number of teachings in Applicants' specification, such as the following:

1. The non-stoichiometric composition of the p-type and n-type thermoelements is obtained by the explicitly disclosed simultaneous sputtering methods (co-sputtering of two different compound targets as discussed in the Examples), which are known to those of ordinary skill in the art to be non-equilibrium processes that would result in forming a non-stoichiometric compound. For example, see:

- ✓ The specification at p. 12, line 27 – page 13, line 5, wherein the specification states: "The thin films forming the TE elements may be sputter deposited ... simultaneously from two of three possible sources, for example, and not meant to be limiting, Bi_2Te_3, Sb_2Te_3 and Bi_2Se_3 alloys, or combinations thereof. The amount of RF power supplied to each of the targets, substrate temperature and sputtering gas pressure are varied for deposition conditions that result in films with desired properties which in turn depend upon the application of the device. Representative thin film material parameters and sputtering conditions are shown in FIG. 11." One of ordinary skill in the art will understand that co-sputtering from such targets to produce semiconductor materials may form non-stoichiometric compounds.

- ✓ The specification at page 10, lines 6-10, wherein the specification states: " ... semiconductors and related alloys based on Bi_xTe_y, Sb_xTe_y and Bi_xSe_y where x is typically about 2 and y is typically about 3. The values of x and y may vary depending upon the power supplied to the sputter deposition targets (or equivalently the flux coming from each target)." Here the "about 2" and "about 3" values of x and y (i.e., non-natural numbers) being varied by sputter deposition – again presents an implicit if not explicit indication to those of ordinary skill in the art that non-stoichiometric compounds are being formed.

- ✓ Examples 1 and 2 both show a variety of co-sputtering conditions and parameters that actually produce non-stoichiometric compounds[2] and such would be recognized by those persons skilled in the relevant art.

- ✓ Representative thin film compound parameters and co-sputtering conditions are illustrated in Figure 11,[3] which one of ordinary skill in the art would recognize as leading to the formation of non-stoichiometric compounds. Specifically, persons skilled in the art recognize from Applicants' experimental results summarized in Figure 11 that the formation of non-incidental amounts of non-stoichiometry in the co-deposited system Sb_2Te_3/Bi_2Te_3 would be the principal cause for the varying of the observed Seebeck coefficients of both p- and n-type material with varying electrical conductivity as sputtering power and process temperature (using co-sputtered sources of initially stoichiometric materials). Through review of the Figure 11 results it is clear that Applicants' objective success in achieving non-incidental non-stoichiometry as a means for developing the desired relationship between Seebeck coefficient and electrical conductivity of the co-sputtered deposits used to form the thin films of the thermocouples in order to offer a device having superior thermoelectric performance than that which can be achieved with stoichiometric thin film compounds.

- ✓ In fact, the Examiner himself admits in the April 13, 2009 Office action that one of ordinary skill in the art would recognize that co-sputter deposition from $(Bi, Sb)_2Te_3$ and Sb_2Te_3 targets (as disclosed in the present application) can produce non-incidental amounts of non-stoichiometric compounds. Specifically, on page 10 of the Office action the Examiner states Böttner is cited as "teaching co-sputtered non-incidental amounts of non-stoichiometric thin films of n- and p-type bismuth/antimony telluride compounds…". The Examiner again in the Office action, at page 13, asserts that co-sputtering is known by persons skilled in the art to produce non-stoichiometric compounds. -- Thus, the Examiner asserts diametrically opposed arguments. He first implies (by failing to note the disclosure of co-sputtering in the application) that Applicants' disclosure violates the §112 written description requirements because descriptions of co-sputtering allegedly are insufficient to indicate to persons skilled in the art that non-stoichiometric compounds could be formed. But the Examiner then makes a § 103 rejection asserting that co-sputtering methods disclosed in Böttner allegedly make obvious that non-stoichiometric compounds may be formed. The Examiner does so even though the Böttner reference is

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[2] Thus providing §112 support for written description purposes as well as enablement.
[3] Also providing §112 support for written description purposes as well as enablement.

non-enabling for co-sputtering methods while Applicants' specification provides copious details and examples for making non-stoichiometric compounds by co-sputtering methods.

2. Furthermore, the recitation throughout the specification of Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y materials where x is typically <u>about</u> 2 and y is typically <u>about</u> 3 is likewise, on its own, a description known to those skilled in the art to denote potential non-stoichiometry of the compound. That is, as those skilled in the art know, non-stoichiometric compounds are chemical compounds with an elemental composition that cannot be represented by a ratio of well-defined natural numbers, and therefore violate the law of definite proportions. Obviously the continuously repeated recitation in the specification of "<u>about</u> 2" and "<u>about</u> 3" indicate non-stoichiometry.

- When a disclosure describes a claimed invention in a manner that permits one skilled in the art to reasonably conclude that the inventor possessed the claimed invention the written description requirement is satisfied. (MPEP §2163). This possession may be shown in any number of ways and an Applicant need not describe every claim feature exactly because there is no *in haec verba* requirement. (MPEP § 2163). Rather, to satisfy the written description requirement, all that is required is "reasonable clarity." (MPEP § 2163.02). Also, an adequate description may be made in any way through express, implicit, or even inherent disclosures in the application, including words, structures, figures, diagrams, and/or formulae. (MPEP §§ 2163(I), 2163.02).

Figure 11 in the present application further indicates to those of ordinary skill in the art the non-stoichiometry produced by the simultaneous sputtering (co-sputtering) of the identified targets (as well as the other specification evidence noted above). Those of ordinary skill in the art would understand that such a disclosure explicitly states or at least implicitly discloses the presence of non-stoichiometric compounds to be used as thin films for the thermoelectric elements.

In view of the foregoing, Applicants respectfully submit that ordinarily skilled artisans would reasonably conclude that Applicant possessed the claimed non-stoichiometric compounds (as well as enabled the making of such) on the basis of the aforementioned explicit and implicit descriptions. Applicant further submits that this conclusion is buttressed by the high-level of education and sophistication of those persons skilled in the art, the Examiner's own admissions of such in the April 13, 2009 Office Action, and because § 112, first paragraph adequate disclosure need not be express. Thus, the present application adequately describes the claimed invention and Applicants respectfully request favorable reconsideration and withdrawal of the rejection under § 112, first paragraph.

In the event that the Office maintains this rejection, Applicants respectfully request, that the Office explain how the aforementioned portions of the present application fail to communicate to a skilled artisan that Applicant possessed the claimed invention.

B. *In addition to the §112, first paragraph rejection, claims 1, 3 and 5-18 were rejected under § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.* The Examiner asserts that it is not clear what is meant by the limitation to "greater than an incidental amount of a non-stoichiometric compound". Although Applicants disagree as one of ordinary skill in the art would readily understand what is meant by "incidental" (see comment in footnote 1), since claim 1, as amended herein, no longer recites "greater than an incidental amount of ..." this rejection is moot.

Claims Rejections - 35 USC § 103

A. Claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Migowski in view of Böttner (21st Int'l Conf. on Thermoelectronics reference). Applicants traverse.

The Examiner acknowledges that Migowski does not teach or suggest thermoelectric elements formed of non-stoichiometric or co-sputter deposited thin film materials as disclosed and claimed in the present application.

Contrary to the Examiner's assertions, however, Böttner also fails to teach or suggest such compounds as the disclosure does not provide sufficient detail for one of ordinary skill in the art to make the compounds for which it is being cited by the Examiner. That is, Böttner does not enable one of ordinary skill in the art to produce the disclosed and claimed non-stoichiometric compounds of the present application or even the compounds disclosed in the Böttner reference itself.

Prior art references must be enabling for a person skilled in the art to practice the invention as claimed. See, e.g., MPEP §§ 2131.01(A) and 2121.01. Thus, for an Examiner to rely on Böttner in a prior art rejection, the reference must teach how to make the claimed thin film materials.[4]

> The disclosure in an assertedly anticipating reference must provide an enabling disclosure of the desired subject matter; mere naming or description of the subject matter is insufficient if it cannot be produced without undue experimentation. *Elan Pharm., Inc. v. Mayo Found. For Med. Educ. & Research*, 346 F.3d 1051, 1054, 68 USPQ 2d 1373, 1376 (Fed. Cir. 2003).

The naming of a compound in a reference, without more, cannot constitute a description of the compound and the reference is not enabling prior art. One of ordinary skill in the art must be able to make or synthesize the compound for the reference to be considered enabling prior art for the teaching of the compound to be made. See, MPEP § 2121.02 and *In re Hoeksema*, 399 F.2d 269, 158 USPQ 596

[4] In *In re Kubin*, 561 F.3d 1351 (Fed. Cir. 2009) **the court further confirmed** the court's holding in *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988), **as reinvigorated by the court in *KSR*** (*KSR Int'1 Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), **that the cited references must contain "detailed enabling methodology for practicing the claimed invention**, a suggestion to modify the prior art to practice the claimed invention, and evidence suggesting that it would be successful."

(CCPA 1968). The Böttner reference does not enable a person of ordinary skill in the art to make the claimed non-stoichiometric compounds or even enable a skilled person to make the compounds Böttner himself discloses.

Böttner discloses some information regarding a particular p-type material but fails to provide sufficient information for a person of skill in the art to make the material. The first line in the section "Growth of Thermoelectric materials" (page 514), referred to by the Examiner, makes a mere statement that "n-Bi_2Te_3 and p-$(Bi,Sb)_2Te_3$ materials were grown by co-sputtering from 6" elemental targets but Böttner fails to teach how to make the p-type material. There is no disclosure in Böttner at all as to the parameters for making such compounds, for example, the power levels applied to the targets, the magnitude of the atomic flux emitted from each target, the substrate temperatures maintained during deposition, the temperatures used to anneal the films to adjust properties as disclosed or even the specifics as to the target materials to be used. One might guess that elemental targets of Bi and Sb were used to grow the films with particular Bi/Sb ratios but that is not sufficient detail to be able to make the compositions without undue experimentation and is merely a guess at just one parameter detail needed. Böttner completely fails to provide the detail needed to make a p-type material that has Bi, Sb and Te components as recited in the article.

Figure 11a, referred to by the Examiner, describes values for Seebeck coefficients of particular p-type materials versus Te content. The films are referred to as (Bi,Sb,Te) materials but again, Böttner does not disclose how to grow materials with such properties.

Lastly, although Böttner briefly mentions the potential use of selenium as a component, films were not deposited that incorporated selenium. Furthermore, the author refers to annealing materials to adjust thermoelectric properties. Figure 10a describes Seebeck coefficient of films versus Te content in atomic percent. Data are presented for cold sputtered and hot sputtered Bi_2Te_3, and annealed materials. There is no indication in the article, however, that the information recited in Fig. 10a are for co-sputter films from bismuth and tellurium targets and there is no teaching in Böttner as to how to obtain compounds that would have the values listed in Figure 10a. For example, there is no information provided regarding the values of power applied to Bi and Te targets, and no detail provided concerning substrate temperatures used during sputtering as well as annealing temperatures. Thus, the publication does not teach how to make the Böttner n-type material for which the Examiner is citing this reference.

In sum, Böttner fails to enable one of ordinary skill in the art to make the claimed compounds as he merely indicates that elemental targets of Bi, Sb and Te were used to deposit n-Bi_2Te_3 and p-$(Bi,Sb)_2Te_3$ materials and refers to annealing the materials to adjust properties without any further detail. Böttner does not teach a skilled person how to achieve making his disclosed compounds having the disclosed properties. For example the following information needed to make the compounds for which the Examiner cites the Böttner reference, is not provided:

(1) Power levels applied to targets, or the magnitude of the atomic flux emitted from each target;
(2) Substrate temperatures required during deposition;

(3) Temperatures used to anneal the films to adjust properties as disclosed; or

(4) The approach used for growth of p-$(Bi,Sb)_2Te_3$ materials.

Without such information, the reference is not enabling for that which the Examiner cites it as allegedly teaching and thus, does not make up for the deficiencies of the Migowski reference.

Accordingly, at least for the reasons listed above, claim 1 and <u>claims 3, 5-10, 12-15, 17, and 18</u> are allowable over the art of record.

<u>Claims 37-39</u> recite the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3. As discussed above, nothing in Migowski or Böttner teach or suggest with sufficient enablement, Sb_xTe_y or Bi_xSe_y thermoelement materials. Accordingly, claims 37-39 are allowable over the art of record.

B. Claims 11 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Migowski and Böttner as applied to claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 above, and further in view of Bass et al. (US 6,207,887). Applicants traverse.

Because, as discussed above, Böttner fails to make up for the deficiencies of Migowski (and because Bass has no disclosure that could even arguably make up for the noted deficiencies of Migowski and Böttner) at least for the reasons listed above, claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 are allowable over the art of record.

Respectfully submitted,

KLARQUIST SPARKMAN, LLP

By

Lisa M. Caldwell
Registration No. 41,653

One World Trade Center, Suite 1600
121 S.W. Salmon Street
Portland, Oregon 97204
Telephone: (503) 595-5300
Facsimile: (503) 595-5301